Logic Functions and Logic Gates

Lecture 3

Logic gates

- A logic gate is a electronic circuit which use to solve arithmetic, algebraic and logical problems in a computer. It is most use in digital electronics and artificial intelligence.

Basic gates

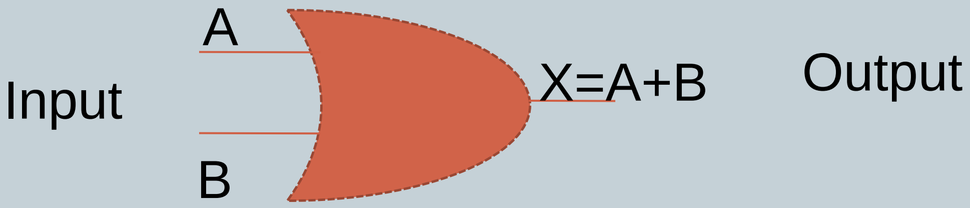
- **AND gate, OR gate, NOT** gate. These three gates known basic gates. These are also called fundamental gates.

- Another NAND and NOR two gates known as a Universal gates.

OR Gate

- Two or more inputs and only one output.
- If all the inputs are false then the output will be false, otherwise the output will be true.

Symbol:



OR

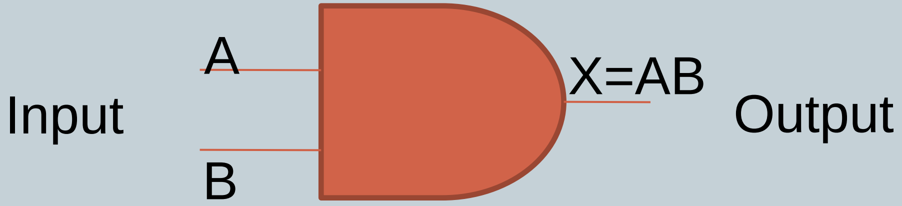
Truth Table: 2 input

A	*B*	A+B
0	0	0
0	1	1
1	0	1
1	1	1

AND Gate

- Two or more inputs and only one output.
- If all the inputs are true the output will be true, otherwise the output will be false.

Symbol:



AND

Truth Table: 2 input

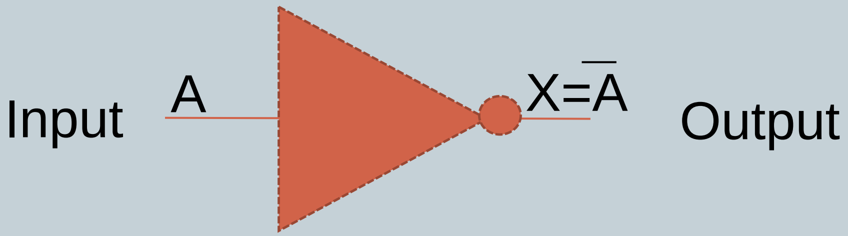
A	***B***	**AB**
0	0	0
0	1	0
1	0	0
1	1	1

NOT Gate/Inverter

- Only one input and one output

- If the input is false then the output will be true and if the input is true then the output will be false.

Symbol:



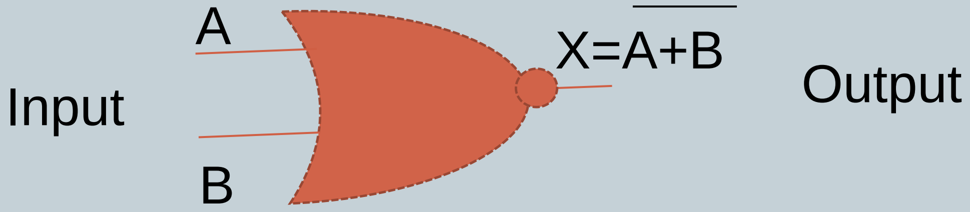
INVERTER

Truth Table:

A	$\overline{A}$
0	1
1	0

NOR Gate

- Two or more inputs and only one output.
- If all the inputs are false the output will be true, otherwise the output will be false.
- Symbol:



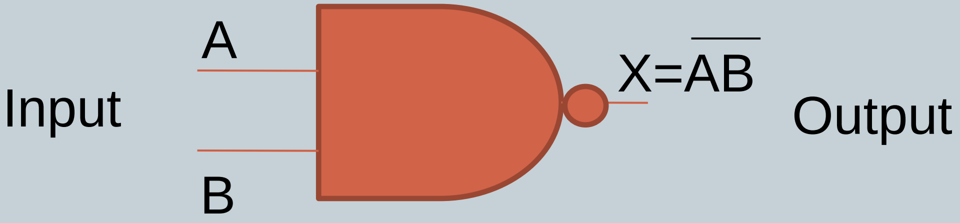
NOR

Truth Table: 2 input

A	***B***	$\overline{A+B}$
0	0	1
0	1	0
1	0	0
1	1	0

NAND Gate

- Two or more inputs and only one output.
- If all the inputs are true the output will be false, otherwise the output will be true.
- Symbol:



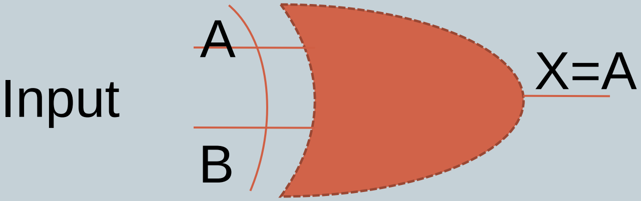
NAND

Truth Table:

A	***B***	$\overline{AB}$
0	0	1
0	1	1
1	0	1
1	1	0

XOR Gate

- Two inputs and only one output.
- An EXCLUSIVE OR gate is just like an OR gate except that the output is not TRUE when the both inputs are true.
- Symbol:



$X = A \oplus B = \bar{A}B + A\bar{B}$

XOR

Truth Table:

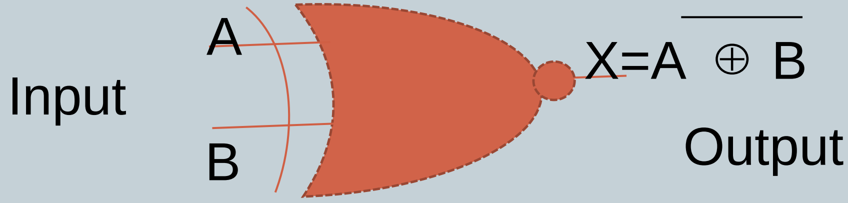
A	*B*	A⊕B
0	0	0
0	1	1
1	0	1
1	1	0

XNOR Gate

- Two inputs and only one output.

- If all the inputs are true/false the output will be true, otherwise the output will be false.

- Symbol:



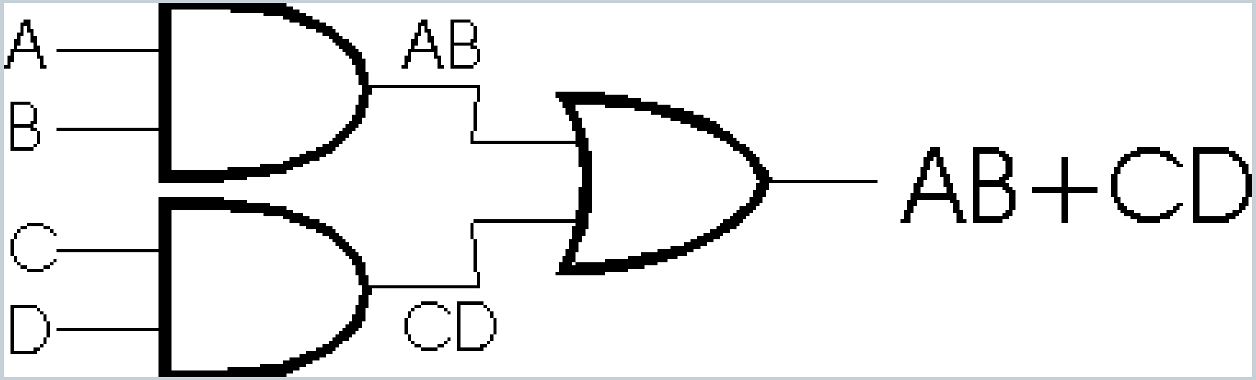
XNOR

Truth Table:

A	B	$\overline{A \oplus B}$
0	0	1
0	1	0
1	0	0
1	1	1

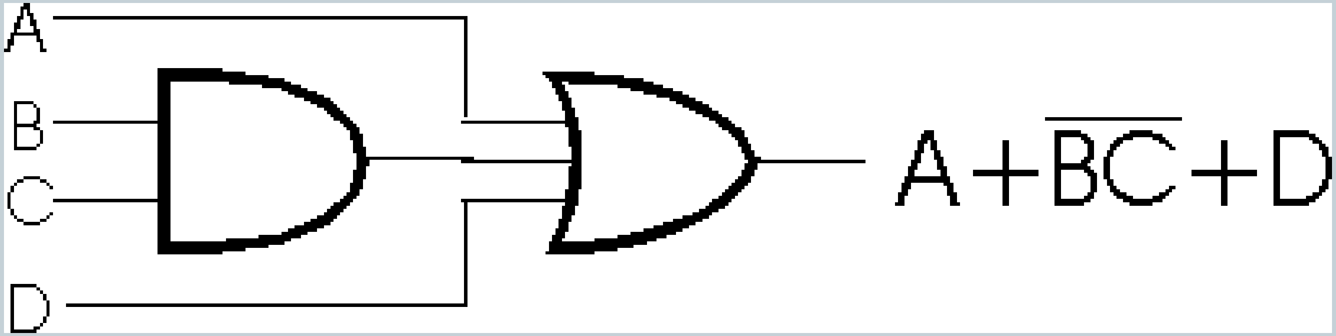
Logic Circuits and Boolean algebra

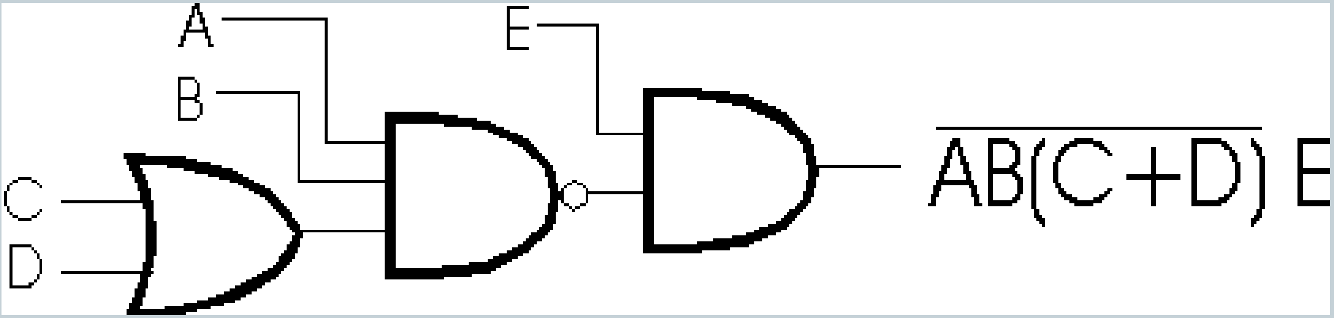
- Boolean expressions can be computed by implementing them in hardware using logic gates.
- Example: Consider the Boolean expression **AB+CD**. The corresponding digital logic circuit is:



Logic Circuits and Boolean algebra (Cont…)

- **Other examples:**





Practice

1. Draw digital logic circuits for these Boolean expressions:

$$AB\overline{C}\,\overline{D}$$

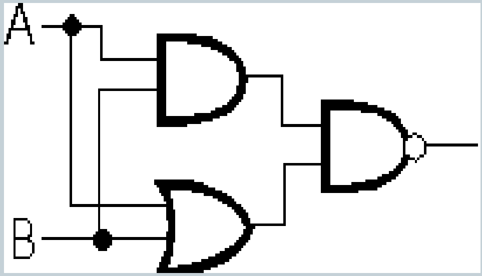
$$\overline{ABCD}$$

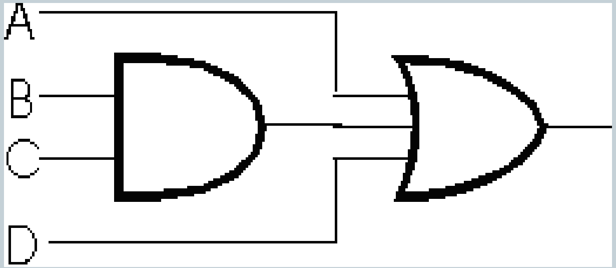
$$(AB+CD)\overline{AD}$$

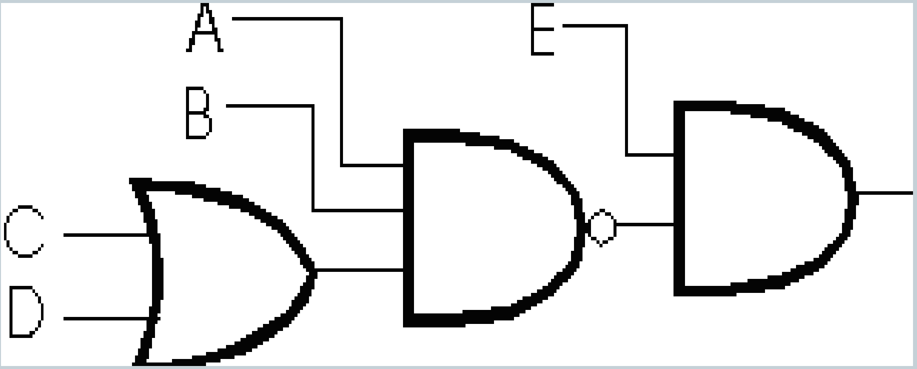
$$(AC+\overline{B+CD})E$$

Practice

2. Give the equivalent Boolean expressions for these digital logic circuits:







End of Lecture

Thanks to All